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390. *SINOPORA DENDROIDEA* (YOH), AUROPORID CORAL, FROM LATE PERMIAN OF WESTERN HONSHU*

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帝釈石灰岩産后期二畳紀珊瑚 *Sinopora dendroidea* (YOH): 表記石灰岩の古藻学研究の副産物として，その上部二畳系部 (*Yabeina* Zone) より Tethys 海特有の珊瑚種 *Sinopora dendroidea* (YOH) が見出されたので記載し，併せてその層位学上の分布を総括した。

小 西 健 二

A *Sinopora* identified with *S. dendroidea* (YOH) was found as a byproduct of a search for calcareous algae in the Permo-Carboniferous limestone complex of Taishaku district, western Honshu, Japan. Though the species has been known as an element of the Permian Tethyan coral fauna, this is the first time to be described from Japan.

The coral, from the Taishaku limestone complex is not uncommon in a gray, compact calcilutite, which contains debris of various microorganisms such as smaller Foraminifera, *Nubercularia*, fusulinids (*Yabeina*, *Codonofusiella*), *Nigriporella*, calcareous algae (*Mizzia velebitana*, *Gymnocodium japonicum*), and so on. The matrix of the calcilutite is so completely indurated that the corallites of the coral cannot be separated for an examination of their growth habit. The entire study is, thus, based on thin sections.

The locality of the specimens examined is about 1 km east of Zenbutsuji-dani, Niisaka-mura, Hiba-gun, Hiroshima Prefecture (Loc. KK 53112812). This is located within the Upper Permian Zenbutsuji-dani formation of YOKOYAMA.

* Received April 6, 1959; read Sept. 23, 1960.

The author thanks to Dr. Helen DUNCAN at the United States National Museum, Washington, D. C., for her assistance given in the course of this study.

Description of Fossil

Order Tabulata MILNE-EDWARDS and HAIME, 1850

Family Auloporidae MILNE-EDWARDS and HAIME, 1851

Subfamily Auloporinae MILNE-EDWARDS and HAIME, 1851

Genus *Sinopora* SOKOLOV, 1955

Type Species: — *Monilopora dendroidea* YOH (*in* YOH and HUANG, 1932, p. 10-12, pl. 2, figs. 3-4)

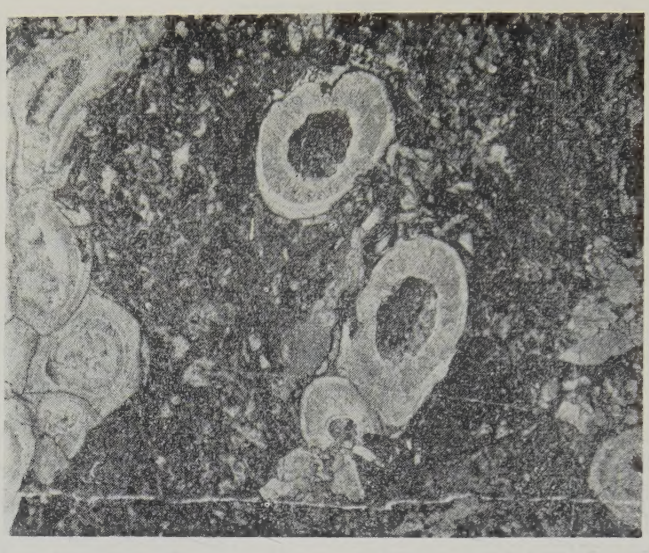
Sinopora dendroidea (YOH)

Text-figures 1 & 2.

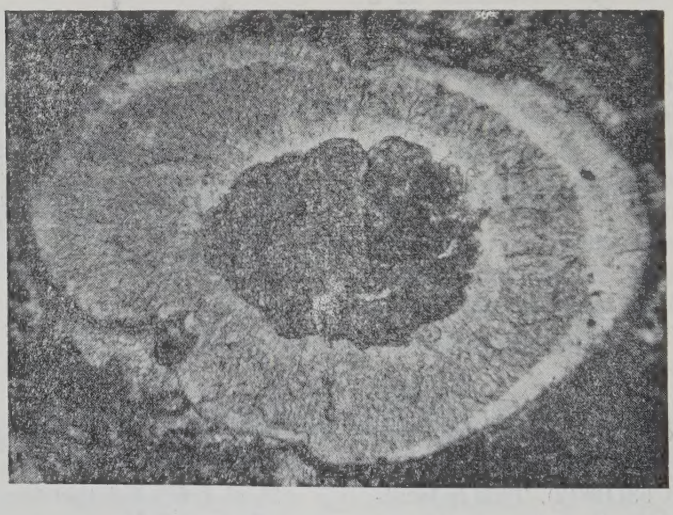
Monilopora dendroidea YOH in YOH and HUANG, 1932, p. 10-12, pl. 2, figs. 3-4; HUANG, 1932, p. 111; HERITSCH, 1934, p. 28, pl. 1, figs. 3-4, text-figs. 1-2; DOUGLAS, 1936, p. 7 & 26.

Cladochonus dendroides BRANSON, 1948, p. 127.

Sinopora dendroidea SOKOLOV, 1955, p. 116, pl. 52, figs. 1-7; WANG-SHIH, 1957, p. 341-342, pl. 2, figs. 10-11.



Text-fig. 1. *Sinopora dendroidea* (YOH). Cross sections. Notice corallites in contact with each other at the left end of the figure. About 1 km east of Zenbutsujidani, Niisaka-mura, Hiba-gun, Hiroshima Prefecture, Honshu. Upper Permian Zenbutsujidani formation. (Slide KK 53112812-12; Repository, Geol. Inst., Univ. Tokyo) ×9.



Text-fig. 2. *Sinopora dendroidea* (YOH). Part of the text-fig. 1. One of the cross sections. Notice two conspicuous zones of wall. ×32.

(Photo. by J. H. JOHNSON)

Observation:—According to YOH (HUANG, 1932), the species is characterized by "(1) the dendroid form of branching corallites, (2) the exceptionally thick external wall, and (3) the complete absence of both tabulae and septa." These features are well recognized in the Japanese form.

Corallites are long, cylindrical, irregularly ramifying, generally wide spaced, although not uncommonly they come in contact with each other without any epithecal modification. The diameter of the corallites ranges from 1.54 to 1.81 mm with average of 1.66 mm. As YOH described, the external wall of the corallites consists of two conspicuous zones; the outer zone of reticulate stereozone, light-colored, variable in thickness, though in general in the order of 0.1 to 0.2 mm, and the inner zone composed from fine, irregularly crenulated, hair-like structure, darker in color. The wall as a whole ranges from 0.38 to 0.62 mm in thickness. No laminar structure was observed. These measurements are also identical with those of *M. dendroidea* described from China and Yugoslavia.

Distribution:—This species appears to be an element of the Tethyan coral fauna during Late Permian. The species was first established on the material from the "Zone of *Tetrapora elegantula*" in the Chihsia limestone at Chi-hsia-shan (type locality), and other places such as Chi-lung-shan, Ho-chou, Southeastern Anhui (Lower Yantze Valley), Chuan-shan of Chii-jung-hsien, South Kiangsu, and Ssu-tze-kon near Tsao-hsien, East Anhui. Later it was also found from the Chihsia limestone at Lungtungpei, Kuangiisnhsien, Northern Szechuan. Recently, the species was reported from the middle part of the Wuchiaping limestone of Liangshan, Hanchung, Southern Shensi, which "may belong to the upper part of the Upper Permian and may be equivalent to the Changhsing limestone and the upper part of the Choutang Series in South China" (WANG-SHIH, 1957, p. 334).

HERITSCH (1934) described the species from the Upper Permian limestone at Likodra, western Serbia, Yugoslavia. DOUGLAS' (1936) report from Tang-i-Shahkuh in Baktihari country, southwestern Iran suggests Upper Permian in age, although only the identified was *Rhombopora polyporata* WAAGEN.

The Taishaku specimens on hand are safely dated Upper Permian—Zone of *Yabeina* or uppermost Akasakan—because of the fusuline associates with as *Yabeina* and *Codonofusiella* as well as algal associates such as *Mizzia velebitana* SCHUBERT and *Gymnocodium japonicum* KONISHI, both of which are very common in *Yabeina globosa* zone of the Japanese Islands.

Repository:—All the studied specimens including the illustrated specimens are to be deposited in the Geological Institute, University of Tokyo; a part of a hand specimen is to be kept at the U.S. National Museum.

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391. ON THE NEW NYMPHAEACEAN PLANT FROM THE ÔMICHIDANI BED (CRETACEOUS SYSTEM), ISHIKAWA PREFECTURE, CENTRAL JAPAN*

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石川県大道谷層（白亜系）に産出した ヒツジグサ科の新種について： 北米大陸の白亜紀から暁新世の湖成層に多産する小型水生植物として *Trapa* ? *microphylla* がある。この種を Bell (1949) が *Nymphaeites angulatus* と改名した。この種の特徴は葉片の印象面に丸い細かい凹みが見られることと，主葉脈が葉柄の先端附近から放射状に出て，細葉脈が多角形の篩目を示す事などである。

大道谷谷峠トンネル附近産のものをこれに比較すると稍々小型である点と，産出の層準が古い点が異なつている。葉片の印象が *Trapa* よりも寧ろ *Trapella* に似ているので *N. trapelloides* と称する。尚，北海道，岩手県久慈地方の上部白亜紀層に産出せる *Glossozamites* ? *imaii* は *N. angulatus* に，和歌山県湯浅町附近の下部白亜紀層に産出した *Sagenopteris* ? *inequilateralis* は *N. trapelloides*, ポルトガルの上部白亜紀層から暁新世の岩層に産出する *Dicotylophyllum cerciforme* は *N. cerciformis* と夫々改名する。又，夫々の産出層準を纏めると Table 2 の様になり，北半球白亜系の湖成層の対比に役立つのではないかと思う。

松　尾　秀　邦

Introduction

Our knowledge on the Nymphaeacean plants of the Cretaceous age of our country is limited, and the only fossil I have hitherto described is *Nelumbo orientalis* in the Asuwa Flora of Fukui Prefecture (1954 ; pp. 155-158, Pl. XX). In this note I am going to describe an additional occurrence represented by small leaves more recently discovered.

The materials originated in the Ômichidani bed at road side near the tunnel of Tanitôge, Shiramine-Mura, Ishikawa-Gun, Ishikawa Prefecture (石川県石川郡白峯村谷峠) of Central Japan.** These specimens had been collected by N. Fuji of our Geological Institute ; he, in 1956, reported these specimens as *Sagenopteris* sp. in his graduation thesis of the Master course in Science in the Institute of Geology and Palaeontology, Tohoku University in Sendai.

When I had an opportunity of studying in the laboratory of Prof. E. Kon'no of the Tohoku University in 1957, as a scholarship researcher of the Educational Department. Prof. Kon'no had not been convinced of Fuji's identification of *Sagenopteris* sp. and advised me to re-examine the specimens more closely. My conclusion is that the fossil plant is *Nymphaeites trapelloides* nov. sp. instead of a *Sagenopteris*.

Before writing on this report, I wish

* Read Nov. 30, 1957 ; received Oct. 23, 1959.

** In 1951, I collected some needle leaves of *Pinus* sp. and *Pseudotsuga* ? sp., and considered them to be of the Tertiary period. In 1959, many specimens of these small leaves with a few leaves of *Ginkgo digitata*, *Sequoia* sp. and *Taxodium* ? sp. etc. were collected by me and some students.

to express my sincere thanks to Prof. KON'NO, for the kind and valuable advice, guidance and generous provision of the material. And also to Dr. I. HAYASAKA, the president of Shimane University in Matsue, for critically reading this manuscript.

Geological Note

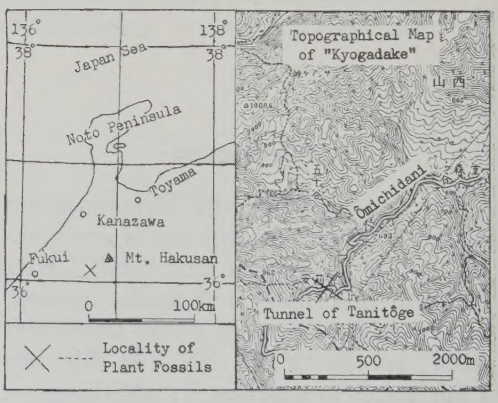
As regards the Ômichidani Bed, Mr. S. MAEDA of Chiba University considered it a formation of the Akaiwa Group belonging to the Jurasso-Cretaceous System (1952 ; p. 316), but Messrs. S. ENDO and M. AMANO (1952 ; p. 317) regarded it younger Cretaceous in age by its contents of fossil plants, collected by Prof. T. KOBAYASHI of Tokyo University and Mr. S. MAEDA.*

More recently, the members of the Kanazawa University made observations that the Ômichidani bed unconformably lies on the Akaiwa Group. Thus, I like to agree with Messrs. ENDO and AMANO's opinion with respect to the age of the flora. They reported some fossils as follows :

Cladophlebis cf. *frigida* HEER
Sagenopteris sp.
Osmunda sp.
Nilssonia a and b spp.
Ginkgoites digitata (BRONGNIART) HEER
Sequoites smithiana HEER
Sequoia heterophylla VELENOVSKY
Trapa (*Trapella*) sp.
Nyssidium sp.
Carpolithus sp.

It is when I described *Nelumbo orientalis* from the upper reaches of the Asuwa-Gawa, Fukui Prefecture, that I proposed to establish the Asuwa Flora. It contains many species of plants (H. MATSUO and S. KIDA : 1953 ; p. 324). Followings are recognized among them :**

Osmunda asuwensis nov. sp.
Cladophlebis frigida (HEER) SEWARD
C. sp.
Nilssonia orientalis HEER
N. *gibbsii* (NEWBERRY) NEWBERRY
N. *acuminata* (PRESL) GÖPPERT
N. *asuwensis* nov. sp.
Cf. *Nilssonia sachalinensis* KRYSHTOFOVICH & BAIKOVSKAYA
Sequoia sp. (Cf. *Sequoia reichenbachi* VELENOVSKY)
Sequoia sp. (cones)
Taxodium sp. (*Taxodium disthicum* ?)
Nelumbo orientalis MATSUO
Nymphaeites sagenopteroides nov. sp.
Phyllites sp. (*Quercus* ? sp.)
Phyllites sp.
Menispermites sp.
Carpolithus sp. (Cycadalean seeds)
C. sp. (*Nissidium*-type)



Text-fig. 1. Locality map of *Nymphaeites trapelloides* in the Ômichidani.

These members of the Asuwa Flora have a very close resemblance to the fossil plants of Ômichidani bed, and are similar to those of the upper Cretaceous floras of Hokkaido (S. ENDO : 1925 ; p. 59), Iwate Prefecture in Honshû (Y. SASSA :

* But the locality of these plant fossils is unknown.

** This flora will be reported by me soon in the Science Reports of Kanazawa University.

1932; p. 429), South-Korea (I. TATEIWA: 1934; p. 193), North Saghalin (H. YABE: 1927; p. 32), Alaska (A. HOLLICK: 1930; pp. 15-16, 24-25, 26, 28-30), Western Canada (W. A. BELL: 1949; pp. 16-25), Portugal (C. TEIXEIRA: 1948; pp. 33-118), etc.

Description of Species

DICOTYLEDONEAE

Order Ranales

Family Nymphaeaceae

Genus *Nymphaeites*
(STERNBERG) BELL 1949

According to the text-book of GOTHAN and WEYLAND (1954; p. 387), the *Nymphaeites* in the family Nymphaeaceae is explained as "Solche nicht näher bestimmbaren Rhizome, Blätter und Früchte werden meist als *Nymphaeites* STERNBERG bezeichnet."

Thus, this genus had been established by STERNBERG for the rhizomes; but most recently, BELL emended STERNBERG's *Nymphaeites*, and remarked as follows:

"—the genus comprises species *incertae sedis* in the family Nymphaeaceae. Originally based on rhizomes (genotype *Nymphaea arethusae* BRONGNIART) the conception of the genus was enlarged by HEER (1870) to include non-peltate leaves with palmate veins branching at acute angles. The genus is here further emended to include non-peltate leaves with mixed pinnate and palmate veins, like those of *Trapa*? *microphylla* LESQUEREUX, as well as peltate or sub-peltate leaves with similar nervation and excentric petiole. It excludes peltate leaves possessing more or less central petiole and radial nerves forking like those of *Nelumbo* or *Cabomba*. which properly belong to *Nelumbites* BERRY.—"

This genus is a small aquatic plant and is known to occur abundantly in the Northern Hemisphere ranging from the Upper Cretaceous to the Palaeocene; of this genus there are forms such as *Trapa* (?) *microphylla* LESQUEREUX in North America, *Dicotylophyllum cerciforme* SAPORTA in Portugal, and *Glossozamites* (?) *imaii* ENDO in Hokkaido and in Iwate Prefecture.

Nymphaeites trapelloides nov. sp.

Pl. 38, figs. 1-5; Text-figs. a-d.

Description: Leaves small, detached, peltate and rounded form, vary in size from 7 to 20 mm long and 4 to 17 mm wide, somewhat enlarged upwards; marked by many fine and rounded pits; fine serration in an upward margin of leaf; base obtuse and petioled; nervation ternate from the petiole, areolation distinct, like pentagonal or hexagonal meshed-form.

This species is seen from the description given above to agree with *Nymphaeites angulatus* (NEWBERRY) BELL from the Palaeocene formation in Alberta and Saskatchewan Counties in Canada.

This *N. angulatus* had been described by NEWBERRY under the name of *Neuropteris angulata* from Colorado State in the United States, of which LESQUEREUX (1878; p. 295, pl. LXI, figs. 16-17a.) revised in *Trapa* (?) *microphylla* in 1874. When he described this species from the Lower Eocene strata of the lignite at Point of Rocks, Wyoming, he remarked

"—no fossil leaves published as yet are to my knowledge comparable to them, except those described by Prof. NEWBERRY under the name of *Neuropteris angulata*—"; and continued

"—these leaves, represented in numer-

ous specimens, vary in size from a little more than 1 cm long, and nearly as large, to about 2.5 cm long and nearly 2 cm broad. They are generally oval, very obtuse, and somewhat enlarged upwards; the borders are minutely dentate except at or near to the base, rounded to comparatively long and slender petiole, the only one of the leaves where it is preserved, not even to its base, being 18 mm long and the petiole 9 mm. The areolation is clearly defined, in very small square or polygonal mesh, formed by close, thick nervilles anastomosing with veinlets parallel to the nerves and their divisions, the parietes being as thick as the veins. The same kind of nervation is observable upon the lower surface of the leaves of the living *Trapa natans* LINNÉ, which though comparable to these fossil ones, have the borders deeply toothed, and are of a much thicker texture.— The general form of the slightly dentate leaves and the remarkably acute angle of divergence of the secondary nerves are the same; even the irregular, though too obscurely maked divisions of the lateral veins seem to be of the same character. It may be remarked, as a kind of confirmation of the reference of these leaves to *Trapa*, that Prof. J. W. DAWSON has observed and described a fruit of this genus, found in connection with his *Lemna scutata* from deposits to those of Points of Rocks.—"

In LESQUEREUX's *Trapa* (?) *microphylla*, figure 16 in plate LXI, has a very close resemblance to *Nymphaeites trapelloides*, but figures 17 and 17a have difference from it in these areolation. And, moreover, LESQUEREUX (1878; pp. 102-103, Pl. LXI, figs. 2, 5.) tried a descriptive investigation on *Lemna scutata* DAWSON in the same paper. I think his figure 5 in plate LXI belongs to the genus *Nymphaeites*, but his figure 2 may be *Lemna*, and should be assumed to be aquatic in life.

Then, BELL (1949; pp. 64-67) explained the *Nymphaeites angulatus* as follows:

"The taxonomic position of *Trapa* (?) *microphylla* LESQUEREUX (*Neuropteris angulata* NEWBERRY) has remained questionable ever since LESQUEREUX's description of the species. —The venation is best displayed by figures of LESQUEREUX and BERRY. Both these authors, however, show the veins terminating craspedodromously at the margins, whereas actually the veins, or at least most of them, in specimens observed by the writer are joined in a pseudo-marginal vein very close to the margin as in *Nymphaeites striatus* (BERRY). Most commonly the finer details of the venation are not preserved, and in many instances the veins are entirely obscured, as if the leaf substance were thick and fleshy. Not uncommonly the surface has a microscopic, granular or pitted appearance. —Although the dominant form of *N. angulatus* has a rounded or truncate base, it may show a variation on the one hand to a more cuneate base, and on the other to a slightly cordate base such as that present in NEWBERRY's type specimens of the species. A variation to the peltate leaf to *Nymphaeites striatus* is likewise strongly suggested. The two species are closely associated in the same beds in both the upper Cretaceous Whitemud and St. Mary River formations. —*Nymphaeites angulatus* was one of the few species that crossed the Cretaceous-Paleocene boundary, but it apparently had its acme in the late Upper Cretaceous time. *Nymphaeites striatus* has not yet been found in Canadian Paleocene formations, a fact that may support its status as a distinct species, but as pond or lake deposits are rarer in these formations, its apparent absence may be due to greater rarity of preservation.—"

I consider, however, that *Nymphaeites striatus* may have no relation with *N. angulatus;* as the former shows the nervation radiating from nearly the central part just like we see in the Braisenian nervation, while the latter shows the nervation ternating from petiole.

Antedating Bell, many other authors were concerned with the *Trapa* (?) *microphylla* Lesquereux more or less; namely Dawson (1887, after Bell), Ward (1886; p. 554, pl. XLIX, figs. 2–5), Knowlton (1889; p. 661, pl. XXVII, figs. 3 and 4), Hollick (1930; p. 109, pl. LXXXIV, fig. 4), Berry (1935; p. 61, pl. XIX, figs. 1–11), Dorf (1942; p. 155, pl. XVII, figs. 1, 2 and 6) and Baikovskaya (1956; pl. XII, figs. 4–7) etc.; but they were in doubt as to whether this fossil belongs to the *Trapa* or not: Berry, among them, said

"—since it can hardly be considered a true *Trapa* in spite of its occurrence in association with aquatic plants, and in spite of the fruits of *Trapa* being found, at least in one instance, in the same bed."

So far as I know, a fruit of this *Nymphaeites trapelloides* has never been associated with leaves, and the areolation does not suggest to be of the modern aquatic plants, *Trapa* and *Trapella*, rather coinciding with that of the Nymphaeacean leaves.

The differences, however, between the new species and *Nymphaeites angulatus* with leaves of larger size, are in two major features. First, there is the difference in the geological occurrence, the new species being yielded from the lower part of the Upper Cretaceous (or the uppermost part of Lower Cretaceous ?) while the other occurring in the Cretaceous-Palaeocene boundary. Secondly, the difference in size of leaves are marked: while the new species shows 7 to 20 mm in length (10 to 12 mm in majority), the other species varies from 4 to 30 mm in length (those from 18 to 20 mm being abundant); evidently the former species is smaller than the latter ones.

This species is named to show that it is *Trapella*-like. Though many authors have named *Trapa ? microphylla* for the *Nymphaeites angulatus*, its leaves more closely resemble those of *Trapella* than of *Trapa*.

Moreover, there are some other species resembling the new species. The first example is *Dicotylophyllum cerciforme* in the Upper Cretaceous bed of Cercal in Portugal, reported by Teixeira (1948; p. 77, pl. XXXI, figs. 9–13). *D. cerciforme* was name by Saporta (1894; p. 147, pl. XXVI, figs. 14, 14a), who established three species of *Dicotylophyllum.** These had been an unknown Dicotyledonean small leaves resembling those of a *Cercis* species. He observed "*D. foliis*, ut apparet, sessilibus, minutis, latiuscule orbiculato-obovatis, margine intergerrimis, basi media leviter emarginato-cordatis; nervo primario vix expresso cum secundariis basi laribusque ante marginem curvato-anastomostis." Teixeira, however, considered that it may be identified to the "Lentilhas de agua (*Lemna*)" which means duckweed. His description is read "—Há certa analogia entre a planta do Cercal e as lentilhas de agua (*Lemna*) actuais."

However, I consider that his species may belong to *Nymphaeites*, but not to the genus *Lemna*, because it shows the Nymphaeacean areolation. Therefore I dare to emend it to the former genus, and call it *Nymphaeites cerciformis*. It is smaller than the *N. trapelloides*, and slight-

* His other two species of *D. hederaceum* (p. 148, pl. XXVI, fig. 15) and *D. corrugatum* (p. 148, pl. XXVI, fig. 16), I consider that they are synonymous with *D. cerciforme*.

ly differs in the pattern of leaf margin, as the former has been unknown to be serrated.

The second example occurred in the Ryoseki Flora (Lower Cretaceous, same as the Wealden Flora) at Tanzaki Yuasa-Machi, Wakayama Prefecture. OISHI (1940; pp. 363-364, pl. XLVII, figs. 3-5: Type specimen is fig. 3.) described as *Sagenopteris ? inequilateralis*. And his description reads as follows:

" —Frond with 4 leaflets; leaflets obovate, inequilateral, about 2 cm long and 1.5 cm broad in their broadest portion, having distinct straight midnerve; lateral nerves obscure; margin appears to be almost entire.— "

According to the margin of leaves, he added notes as

" —The margin of the lamina appears to be almost entire all around, but in the type specimen (fig. 3) and the left specimen in fig. 4 the outer margin of the lamina seems to be slightly serrated or broadly undulating, but this feature is somewhat indistinct— ".

But this figure 5 in plate XLVII, shows some such characters of *Nymphaeites*, as the veins being radiated from the top of petiole, and the fine serration along the upward margin. Therefore I am quite sure that these specimens represent a species of *Nymphaeites*, and that they belong to *N. trapelloides*.

The third example closely resembles *Nymphaeites angulatus* excavated from the *Nilssonia*-bed of Hakobuchi Sandstone Series (the upper most of the Cretaceous System in Hokkaido), which ENDO (1925; pp. 62-63, pl. XVII, figs. 16, 18, 19.) reported as *Glossozamites* (?) *imaii*, the Cycadalean leaves. His description is:

" —Detached leaflets of small size (2 cm long and 1.5 cm wide), rounded ovate, slightly produced to the pointed base, and somewhat asymmetrical; coriaceous; margin seldom smooth, usually showing a few serrations along the upper part. Serrations, long, narrow, acute, and curving upward. Veins numerous, very fine and obsolete; subequal and dichotomous.—"

On investigating his samples in the repository of the Institute of Geology and Palaeontology, Tohoku University in Sendai, I become aware that he committed an unfortunate mistake in the identification. He failed to notice the petiole of leaf and took the Cycadalean venation for the areolation of these leaves. Judging from these characters, it seems clear that *Glossozamites* (?) *imaii* is specifically distinct from Cycadalean species, and I consider that these specimens bear the characteristics of the species of *Nymphaeites* closely related to *N. angulatus* from the upper Cretaceous bed of North America.

These species are thus summerized in the following table 1.

Table 1.

Fossil leaves	Usage in this paper	Occurrence
Dicotylophyllum cerciforme TEIXEIRA 1948	*Nymphaeites cerciformis* emend. MATSUO	Upper Cretaceous in Portugal.
Sagenopteris ? inequilateralis OISHI 1940	*Nymphaeites trapelloides* MATSUO	Lower Cretaceous in Japan.
Glossozamites ? imaii ENDO 1925	*Nymphaeites angulatus* (NEWBERRY) BELL	Upper Cretaceous in Hokkaido.

The distribution and geological significance of these species involve the following three facts: first, *Nymphaeites trapelloides* is an Asian plant and ranges from the Lower to the Upper Cretaceous ages; second, *N. angulatus* is a plant of northern Hemisphere and ranges from the Upper Cretaceous to Palaeogene ages; and third, *N. cerciformis* is an European

plant and occurs in the formations from the Upper Cretaceous to Palaeogene ages.

From the above mentioned, I consider that the *Nymphaeites* referred is a small aquatic plant, and ranges from the Lower Cretaceous to the Palaeogene ages in the Northern Hemisphere. These characters suggest that it is a radiating form in plantation (as shown in the figures of WARD, 1886; pl. XLIX, fig. 5. In BERRY, 1935; pl. XIX, figs. 2, 8–11 and in BELL, 1949, pl. XVII, fig. 4) and has many fine and rounded pits of unknown origin on the surface of leaves. The conclusion is summerized in the following table 2.

Table 2.

Fossil Name	Life Range		
	Low. Creta.	Up. Creta.	Palaeocene
Nymphaeites angulatus (NEWBERRY) BELL 1949	?		
Nymphaeites cerciformis (TEIXEIRA) MATSUO			
Nymphaeites trapelloides MATSUO	?		?

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Postscript

After I sent this report, I have an opportunity to see the reprint of "*Trapa* ? *microphylla* LESQUEREUX, the first occurrence from the Upper Cretaceous formation of China (H. H. LEE ; 1959 : *Acta Palaeontologica Sinica*, Vol. 7, No. 1, pp. 33-40, pl. I, figs. 1-8)" by the favour of Dr. T. KOBAYASHI.

LEE described about this Incertae-sedical species under the name of *Trapa* ? *microphylla*, according to Dr. KRYSHTOFOVICH's report of 1953 who had combined this uncertain small leaf of the fossil plant with *Trapa* ? *microphylla*. Therefore he did not use such names as *Nymphaeites*, *Dicotylophyllum*, *Macclintokia*, *Protorrhipis* etc.

Nevertheless, the presence of this characteristic small plant fossil from the Upper Cretaceous formation (Sungari Series) of China affords further satisfactory palaeobotanical evidence to support the Upper Cretaceous flora of the Northern Hemisphere.

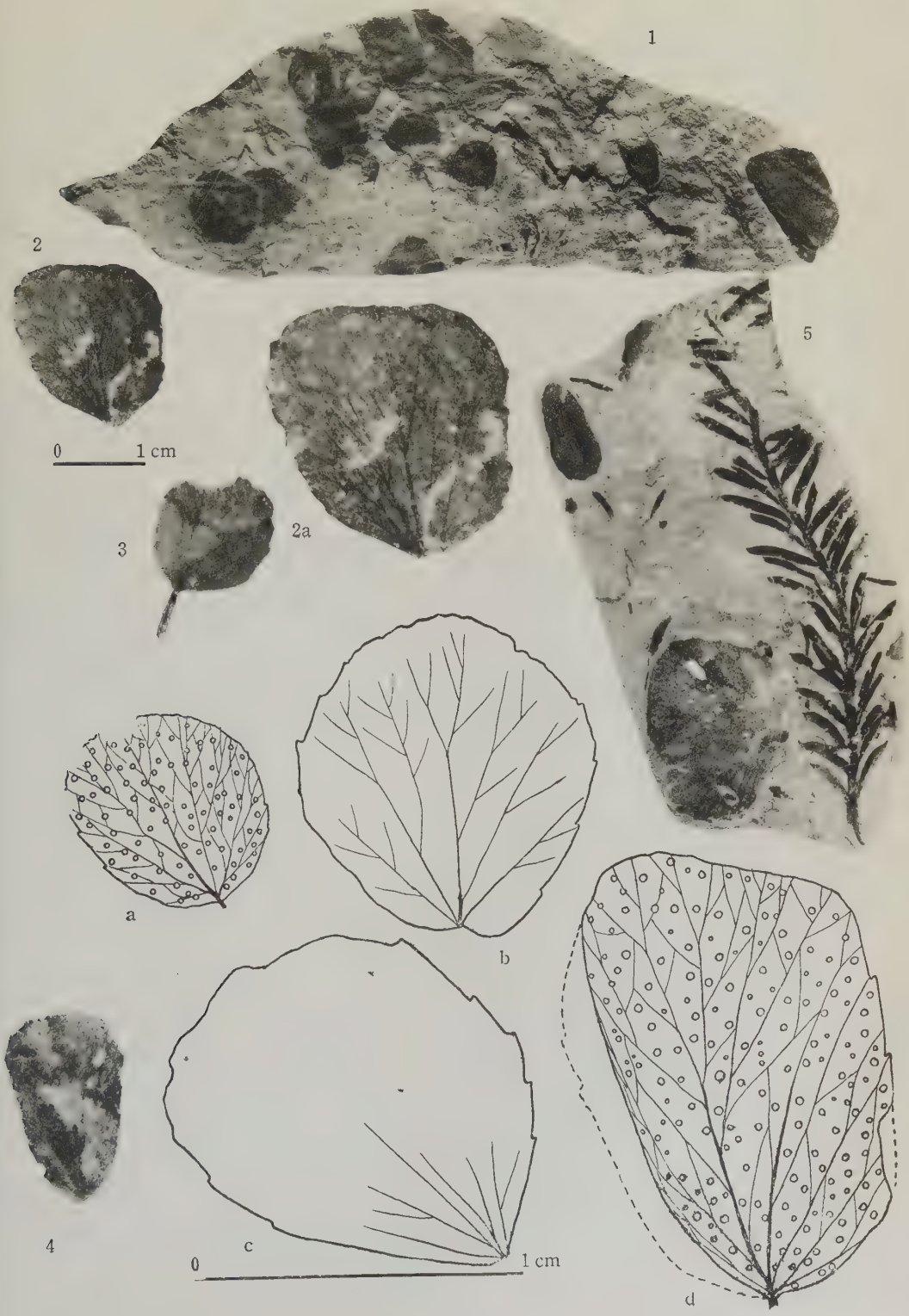
And more, KRYSHTOFOVICH revised *Trapa* ? *microphylla* in 1953, for ENDO's *Glossozamites* ? *imaii* from the *Nilssonia*-bed of Hokkaido (LEE ; 1959 : p. 39).

Explanation of Plate 38

Nymphaeites trapelloides nov. sp.

Locality : Road side near the tunnel of Tanitôge, Ishikawa Prefecture. Repository : Geol. & Palaeont. Inst. Tohoku Univ. Sendai.

Fig. 1. Natural size.
Fig. 2. Holotype. Reg. No. GKZ 10096.
Fig. 2a. Enlarged fig. 2.
Fig. 3. Enlarged same as fig. 2a. Reg. No. GKZ 10099.
Fig. 4. Enlarged same as fig. 2a. Reg. No. GKZ 10098.
Fig. 5. With *Sequoia* sp. (enlarged same as fig. 2a.) Reg. No. GKZ 10097.
Text-figs. a, b, c, d. (enlarged as well).


1
2
0 1 cm
2a
3
5
a
b
4
c
0 1 cm
d

Trans. Proc. Palaeont. Soc. Japan, N. S., No. 40, pp. 337-338, pl. 39, Nov. 30, 1960

392. A FIND OF *PALAEOPNEUSTES* FROM TOTSUKA-KU, YOKOHAMA CITY*

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and

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Kyobashi Upper Secondary Chemical School

横浜市戸塚区上郷町長倉，通称源氏岡産 *Palaeopneustes* について記載し，報告した。
橋 本 亘・柴 田 松 太 郎

An echinoid specimen treated in this short article was collected by Mr. Matsuo Kosuge of the Tatsumi Tochikogyo Co. Ltd., from the place of constructing works of his company at ♯1,516, Nagakura, Kamigô-machi, Totsuka-ku, Yokohama, and was presented to Mr. Tetsuo Shimazu, a teacher of the Zushi Primary School who kindly submitted us for study.

According to the geological map attached to the report of H. Akamine and others (1956), the formation which yielded the present specimen is considered being the Nojima Tuffaceous Siltstone Member of Kanazawa formation of Miura Group.

Before going to description of the species, we wish our cordial thanks to Messrs Tetsuo Shimazu and Matsuo Kosuge for their kind offering. Acknowledgements are also due to Assistant Professor Shôzô Nishiyama of Shimane University for his important informations and advices on the study of the Genus *Palaeopneustes*, and also to Professor Kiyoshi Asano of Tôhoku University who kindly permited to examine the Nishiyama's collection kept in his Institute.

* Received Oct. 26, 1959; read Dec. 7, 1958.

Palaeopneustes aff. *cristatus* A. Agassiz

Plate 39, figures 1-3.

1933. Nishiyama, S., p. 50, figs. 65 A and 65 B.
1950. Mortensen, Th., p. 191, pl. IV, fig. 2; pl. VIII, fig. 1.
1953. Morishita, A., p. 27, pl. III, fig. 1.

Description:—Test roundly conical in profile, comparatively low, oval in outline. No frontal depression. The aboral side arched from margin to apex.

Ambulacra distinctly petaloid and open distally, all petals reached to the ambitus and very slightly sunken adapically but flush with the test distally. They are gradually widened towards the distal ends of petals. The odd anterior petal is narrower than the others. Petals III and IV extend straightly towards the extremities, I and V are somewhat flexuous backwards, II is more or less flexuous forwards. The interporiferous zones are broad. Pore-pairs all alike. The apical system situates central; genital pores and madreporite are indistinct. The periproct is not observed due to lacking of the posterior margin of the test.

The marginal and submarginal fascioles are indistinct. Oral side flat but concave

orally, phyllodes somewhat developed around the peristome. The peristome is lunar in shape and is situated at nearly 1/6 diameter distant from the anterior margin. The labrum and sternum are not observed due to lacking of this area:

Dimensions:—92.6 mm. in length, about 80.0 mm. in width, and 32.5 mm. in height.

Remarks:—We have already known three reports (1931, 1933 and 1953) on the fossil echinoids referred to Palaeopneustidae from Japan. Very recently, H. UJIIE described *Linopneustes* sp. from the middle part of the Horinouchi formation, Kakegawa group (in press).

The present form differs from *Palaeopneustes cristatus* in its lower height and the longer ambulacra and stands nearer to the *Palaeopneustes* cf. *cristatus* A. AGASSIZ of MORISHITA (1953) or *Palaeopneustes* sp. nov. of NISHIYAMA (1931) from Sôma, Fukushima Prefecture. In every aspects, these three species seem to us that they probably belong to one and the same species, however, we feel some hesitation to establish a new species based on the present specimen due to its incompleteness of some important part though it is very slight.

It is noteworthy that the echinoid species belonging to Palaeopneustidae, as far as described, usually occur in the alternation of sandstone and mudstone of Tertiary age, especially of the lower Pliocene age, as already stated by A. MORISHITA, on the other hand, according to S. NISHIYAMA, this family became dominant from the Upper Miocene to Pliocene times in Japan.

Repository:—The Institute of Geol. and Min., Tokyô Univ. of Education, Reg. No. 6270.

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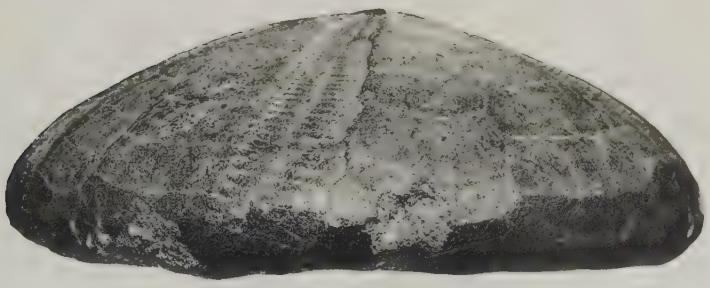
Explanation of Plate 39

(All figures are in natural size)

Palaeopneustes aff. *cristatus* A. AGASSIZ.

1



2

3

S. Aoki photo.

Trans. Proc. Palaeont. Soc. Japan, N. S., No. 40, pp. 339-351, pls. 40-41, Nov. 30, 1960

393. A NEW *NEOCALAMITES* FROM THE CARNIC FORMATION IN JAPAN WITH BRIEF NOTES ON *NEOCALAMITES* AND *LOBATANNULARIA* IN ASIA*

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and

GENTARO NAITO

Oomine Upper Secondary School

山口県 Carnic 層（桃木層）産 *Neocalamites* の１新種の記載並びに東亜産の *Neocalamites* 及び *Lobatannularia*：本標本はさきに *Lobatannularia* と考えていたがその後東亜産の *Neocalamites* と *Lobatannularia* とを詳細に比較検討した結果こゝに *Neocalamites* の新種として発表することにした。　今野円蔵・内藤源太朗

Introduction and Acknowledgements

This paper contains a description of a new species of *Neocalamites* collected by N. Okabe and the junior author in 1954 from the Momonoki formation of the Miné Group at about Lat. 34°11′ N. and Long. 131°10′ E., Yamaguchi Prefecture, Japan, with some brief notes on *Neocalamites* and *Lobatannularia* in Asia. After his preliminary investigation, the junior author entrusted the senior with detailed examination of his materials, which are deposited in Geological and Paleontological Institute of the Tohoku University (IGPS). Mainly because of the presence of the large terminal leaf-whorl as well as the lateral one divided into two lobes, both showing somewhat marked anisophylly, the present authors referred these specimens at first to *Lobatannularia*, but they would now prefer to bring them into *Neocalamites* for reasons, which will be given and discussed in details in the present paper.

The Miné Group is generally subdivided into such three formations as in descending order: Aso, Momonoki, and Hirabara. Of them the Momonoki formation, though *Halobia* sp. aff. *aotii* was collected by the junior author from its uppermost horizon, consists mainly of non-marine sediments with rich plant fossils and several workable coal-seams, overlain conformably by the Aso formation and underlain with some slight disconformity by the Hirabara. (Hase, 1950, pp. 113-119; Tokuyama, 1958, pp. 454-463). According to the correlation-table of the Triassic System in the Yamaguchi Prefecture given by T. Kobayashi, K. Ichikawa and A. Hase (Ichikawa, 1951, p. 2), the Miné Group is considered as Carnic in age, representing the lower half of the Neo-Triassic Series in Japan, and thus the lower part of the Momonoki formation, from which our present specimens were collected, is safely referable to

* Received Nov. 16, 1959; read Nov. 30 1957.

the Carnic or rather to the middle of it.

Before presenting the description, they wish to express their sincere thanks to Professor Emeritus H. YABE and Professor S. HANZAWA, of the Tohoku University, for their kind helps to complete the present studies. Thanks are also due to Dr. K. ASAMA of the Tohoku University and Professor N. KOBATAKE of Institute of Geological Science, South College, Osaka University, who gave us many opportunities for discussion of *Lobatannularia* and its allied genera. This study was partly financed by a grant from the Science Research Fund of the Ministry of Education.

Description

Genus *Neocalamites* HALLE, 1908

Neocalamites minensis n. sp.

Pls. 40 and 41, Text-figs. 1, 2.

Type-specimens—IGPS coll. cat. no. 76237 (shown in Pl. 41, fig. 4); IGPS coll. cat. no. 76234 (shown in Pl. 41, fig. 5).

Diagnosis:

(1) Major type of foliage.—Ultimate stem with internodes 45 mm. long by 4 mm. wide in main part, 33 mm. by 1.5 mm. -16 mm. by 1 mm. near apex, longitudinal ridges on surface of narrow apical internode possibly equal to leaves of adjacent leaf whorl in number. Leaf-whorl, large, reniform, composed of 8–12, generally 10 leaves, spreading out in one plane nearly parallel to axis. Lateral leaf-whorl divided into 2 equal groups, one on each side of node, leaving between them large proximal gap of 130°–170° and small apical one of 30°–60° or less; leaves near proximal gap point slightly backwards and then bend outwards and forwards, while those near apical one nearly straight, all of which entirely free down to the base. Terminal whorl well developed. Each leaf-whorl slightly anisophyllous, of which longest leaf 70 mm.–80 mm. in length while shortest one near proximal gap about 45 mm. and thus ratio in length between them 1.8 or less. Leaf-segment linear-lanceolate, 4.0–5.3 mm. across at its widest part, gradually tapered towards sharply pointed mucronate apex and less gradually to basal end where no petiole defined; midrib thick and persistent, 1.2–1.3 mm. across, occupying about one-fourth of maximum width of leaf, terminated in stiff mucro; lamina between midrib and lateral margin traversed by fine and crowded transverse striations.

(2) Minor type of foliage.—Lateral stem with internodes 24–28 mm. long by 1.1–1.3 mm. wide. Leaf-whorl consists of 10 leaves, divided into 2 equal lateral groups with wide proximal gap of 160°–190° between them. Each leaf linear-lanceolate, about 40 mm. long by 2.5 mm. wide in general, with thick midrib of 0.6–0.7 mm. in thickness. Leaves in a whorl generally free to base, but occasionally coalescent for their considerable length. Ratio of length of longest leaf to shortest about 1.4.

Measurements and remarks:

(1) Specimens of Major type.—The one type-specimen shown in Pl. 41, fig. 4 (see also Text-fig. 2B) bears four internodes and four leaf-whorls; the apical whorl seems to represent a real terminal whorl to judge from its individual leaves touching one another for their considerable length and the internode just below being extremely shorter and thinner than the rest. The other specimen also with four joints shown in Pl. 40, fig. 1b coincides with the above mentioned type in every important respect as: the internodes reduce the length successively and

Table 1. Lateral stem of Major type.

Specimen	Internode (mm) Length×Width	Number of leaves in a whorl	Length×Width (mm.)	
			Long leaf	Basal leaf
Pl. 40, f. 1b	16×1, 35×2, 40×2, ?×3	8	60(+)×5	35(+)×5
Pl. 40, f. 1a, Pl. 41, f. 4	16×?, 35×2, 40×2, 45(+)×3	9	72(+)×5.3	35(+)×5
Pl. 40, f. 2	35×2, 45(+)×3	8	?	40(+)×4
Pl. 40, f. 1c	?×1.7	8	60(+)×5	40(+)×4.8
Pl. 41, f. 5	?×2.8	11	75(+)×4.5	40(+)×4.5
Pl. 41, f. 3	40×4	9	?×3.1	?×3
Pl. 41, f. 1	?×5	?	?	?×5

Table 2. Lateral stem of Minor type.

Specimen	Internode (mm) Length×Width	Number of leaves in a whorl	Length×Width (mm.)	
			Long leaf	Basal leaf
Pl. 40, f. 1d	(uppermost) 24×1.1	9	25(+)×2.5	15(+)×2.2
„	(2nd) 28×1.3	8	?×2.5	25(+)×2.2
„	(3rd) 27×1.3	10	40×2.5	?×?
Pl. 41, f. 1e	15×0.9, 16×1	10	?×2.7	?×?

rapidly towards the apex of the shoot; the stem bends, though slightly, at every node to take zigzag shape, but neither branch nor branch-scar can be detected on node even under microscope. The second type-specimen is shown in Pl. 41, fig. 5 and its restoration in Text-fig. 1B. In this specimen the basal part of a leaf-whorl is fairly well preserved, showing the proximal gap is very wide (about 170°), basal leaves very long measuring as long as 35 mm., linear-lanceolate, pointing slightly backwards and then outwards and forwards. Pl. 40, figs. 1c and 2 show two well-developed terminal whorls, in which the shortest basal leaves measure as long as 40 mm. and linear-lanceolate in form. Thus it is quite certain that all these specimens differ essentially from any species of *Lobatannularia* hitherto known.

(2) Specimens of Minor type.—In the specimen shown in Pl. 40, fig. 1d and its illustration in Text-fig. 1A, the terminal whorls are well defined; leaves in a whorl spread out in a plane parallel to the axis, free down to the base, not spatulate but linear-lanceolate even near the basal gap; the ratio in length of the longest leaf to the shortest is 40/28 =1.4. The leaves in a whorl either terminal or lateral are usually free to the base, but occasionally some lateral whorl is divided into two tightly fused lobes

Text-fig. 1. *Neocalamites minensis.*
A: drawing of specimen of Minor type shown in Pl. 40, fig. 1d, where 4 lateral stems are preserved with their axes nearly parallel.
B: type-specimen drawn from the specimen shown in Pl. 41, fig. 5.

as seen on the left-hand side of the uppermost specimen out of the four shown in Text-fig. 1A. Another specimen shown in Pl. 41, fig. 1e (see also Text-fig. 2A), appears to represent apical part of a foliage. This seems quite worthy to note because the stem appears to bear a pair of thin branches with a single internode one on each side of the node; the left-hand one has a thin internode substance of which is actually preserved, but even in this case the feature of its very attaching point to the parent axis is not certain; the other right-hand example appears to have a much shorter internode than the above-said left-hand one, but unfortunately no substance of internode is preserved. At first glance this specimen appears to bear two branches of unequal length one on each side of the node, and if really so, then the ramification of this specimen resembles to a certain extent that of *Lobatannularia*. The ramification is evidently one of the most important criteria to distinguish *Neocalamites* from *Lobatannularia* as will be discussed in the following chapter. Unfortunately, however, the present specimens are too imperfect in preservation to draw any reliable conclusion on the ramification of the present species therefrom.

(3) Relation between the Major and the Minor types.—As shown in Tables 1 and 2, the leaves in the Major type are

Text-fig. 2. *Neocalamites minensis.*
A: distal part of a small stem associated with 2 slender branch-like shoots at a node, drawn from the specimen shown in Pl. 40, fig. 1e.
B: type-specimen drawn from the specimens shown in Pl. 41, fig. 4 and its counterpart shown in Pl. 40, fig. 1a.

typically 75 mm. long by 5-5.3 mm. wide with the midrib 1.3 mm. across, whereas in the Minor type they are 40 mm. long by 2.5 mm. wide with the midrib of 0.63 mm. in width. Thus between these two types there is a considerably wide gap in size, because the leaf of the Major type is about twice as long and wide as that of the other, and so is its midrib in thickness. To ascertain if there are specimens of intermediate size, the maximum width of both lamina(L) and the midrib(M) of all the available specimens at our disposal were carefully measured, and the results (L×M) are given in mm. below:

Major type: 3.0×1.0 (Pl. 41, fig. 3), 4.0 ×1.0, 4.5×1.1, 4.5×1.35, 5.0×1.35, 5.3×1.2.

Minor type: 2 5×0.6, 2.5×0.7, 2.8×0.63.

Intermediate type: 3.0×0.8, 3.8×0.75, 3.9×0.9.

Judging from these measurements excluding 3.0×1.0 (Pl. 41, fig. 3), several leaves included above in the Intermediate type seem to prove the presence of various intermediate sizes linking the other two types with each other. Moreover except the marked departure in size, the Minor type coincides nearly completely with the Major type in feature of a leaf-whorl,—especially in form of the individual leaf-segment. As shown in Tables 1 and 2, the ratio of length to breadth of each leaf-segment ranges in the Minor type from 25/2.5 to 40/2.5, that is from 10 to 16, while in the Major type from 60/5 to 72/5.3, that is from 12 to 14. Judging from all of these evidences it would be more preferable to place the Minor type in one and the same species defined by the type-specimens belonging to the Major type to separating the former type even as a variety of the present species from the latter. To say in other words, such a small size of the Minor type would presumably be due to that it belongs to the distal part of a large leafy main stem represented by the Major type, instead of immaturity in development of a young shoot.

Comparison with other species:

(1) Comparison with *Lobatannularia ensifolia* (Halle).—This Permian species occurs in the Upper Shihhotse Series in Northen China, the *Gigantopteris*-bearing formations in Southern China and the Kobosan Series in Korea. Specimens of our Major type resemble to some extent the specimens of Halle's with leaf-whorls consisting of leaves entirely free to the base, e. g. that shown in his Pl. I, fig. 1 (Halle, 1927). Both of them have such characters in common as: 1) normal leaves are very large and linear traversed by thick midrib with stiff mucro at apex, 2) the terminal whorl is large and fan-shaped and either the terminal or the lateral whorl is flattened in a plane nearly parallel to the axis, 3) lateral leaf-whorl is divided into two distinct lobes with a wide gap between them in the basal side, 4) leaves near the basal gap of a whorl are shorter than the rest. Thus these two species agree with each other in having the dorsiventral ultimate branch with anisophyllous leaf-whorls. But *L. ensifolia* differs rather considerably from the Mine species because in the former 1) leaves near the basal gap of a whorl are much shorter than the rest and spatulate in form, 2) anisophylly is much more pronounced, the longest leaves are at least 3-4 time and sometimes 8 times as long as the shortest ones, whereas in ours they are only 1.8 or less times, 3) leaves of a whorl usually cohere for some distance, while in ours they are entirely free, 4) the stem shows a peculiar ramification called pseudodichotomy. Thus

it is certain that the distinctions between the two species much outweigh the similarities, but it seems worthy to note that these two species, though very remotely separated in age, are equally characterized by the presence of the large fan-shaped terminal whorls and the dorsiventral leafy ultimate shoots.

(2) Comparison with *Lobatannularia ensifolia* (HALLE) var. *nariwaensis* KOBATAKE.—This variety occurs in the Upper Triassic formation near Nariwa District, Japan. KOBATAKE (1954, pp. 71–72, Figs. 1, 2) gave only three illustrations of the detached terminal whorl with short description. To compare them with our terminal whorls of the Major type e. g. those shown in our Pl. 40, fig. 1c and Text-fig. 2A, there are some close resemblances found between them, e. g. the leaf-whorl is anisophyllous, composed of linear and entirely free leaves, provided with a wide gap in the proximal side of the whorl, etc. However, the differences appear to outweigh the similarities, because in the specimens of KOBATAKE's the anisophylly in the leaf-whorl is much more remarkable as clearly shown in his fig. 1, in which the longer leaves in the middle of a whorl measure 60 mm. in length by 8 mm. in width, while the outermost basal ones are 13 mm. by less than 6 mm. and accordingly ratio of length of the longest to the shortest leaf is 60/13=4.5, whereas in the present species it is only 1.8 or less; the leaf-segment of the former is generally shorter and broader than ours by about 70 mm. in length and by 5 mm. in width; basal leaves nearest to the proximal gap of the whorl are spatulate in the former, while in ours they are linear-lanceolate. Among these distinctions, the marked anisophylly is evidently most essential and but for this distinction the variety of KOBATAKE's might hardly be distinguishable from our Miné species. To recognize such the anisophylly correctly, the length of leaves,—especially of those nearest to the basal gap should be correctly measured. In KOBATAKE's illustration of fig. 1 the outermost basal leaf is drawn to have a complete outline. However, it seems strange to find that this basal leaf on the left-hand side of the leaf-whorl points straightly backwards without showing any further outward or forward bending, and further that the adjacent leaf lying just above this basal one appears considerably longer, possibly attaining, according to our estimation, about twice as long as the basal one and if so, then the change in length from the basal leaf to the next upper seems to be too abrupt to be expected as natural. Having no opportunity to examine his specimen for ourselves, we requested KOBATAKE to re-exmine the length of his outermost basal leaf of the specimen shown in his fig. 1. In his kind answer he said that there was no need for his illustration to be corrected, but such missprints in his description of the basal leaf of a whorl in fig. 1 as "18 mm. long by 6 mm." should be corrected as "13 mm. long by a little less than 6 mm.". As to the form of the leaves in the middle of his whorl, KOBATAKE described it as linear-lanceolate, but his illustrations appear to show it is rather linear-oblanceolate, and if so the specimens of KOBATAKE's resemble to a certain extent some of either *Lobatannularia ensifolia* reported by HALLE (1927) or *Annulariopsis inopinata* ZEILLER? by OISHI (1930, pp. 51–52, Pl. VII, fig. 1). Though all of these specimens reported either by KOBATAKE or by OISHI seem too imperfect to permit any reliable comparison with any definite genera as *Lobatannularia*, *Annulariopsis*, etc., they are important in proving that such the

Equisetacean plants characterized by the *Annularia*-like leaf-whorl with oblanceolate leaves were still existing in the Upper Triassic age in Japan.

(3) Comparison with *Neocalamites carcinoides* Harris.—This species was established in 1931 based on numerous specimens from the basal Liassic beds in Greenland (Harris, 1931, pp. 25–30; Pl. IV, figs. 2, 3, 5–7; Pl. V, figs. 1–5; Pl. VI, figs. 1–6; Text-fig. 5A-D.), and recently Sze (1956, pp. 120–122; Pl. I, figs. 1, 1a; Pl. II, figs. 1, 1a, 2; Pl. III, figs. 1–3; Pl. IV, figs. 7, 8; Pl. IX, figs. 1–3) referred his specimens from the Yenchang formation (Carno-Rhaetic) in Northwestern China to this species of Harris's. Harris described two sorts of his specimens of the leaf-bearing shoot, i. e. Type B of lateral stems with normal leaf-whorls and Type C of small stems characterized by leaves fused in two lateral groups, and then he chose the specimen belonging to Type B (Text-fig. 5A) as the type of his species. His type-specimen, which consists of a slender lateral stem with three internodes and three lateral leaf-whorls, resembles very closely that of the present species (Pl. 41, fig. 4; Text-fig. 2B), though in the former the apical part of the shoot is unfortunately missing. In both of these type-specimens of Harris's and ours a leaf-whorl is large, consists of leaves entirely free to the base, flattened in a plane nearly parallel to the axis; lower leaves of a whorl point slightly backwards and then bend outwards and forwards, leaving thus a very wide gap in the basal side of the whorl; a leaf is very long and gradually tapered towards acutely pointed mucronate apex. Our type-specimen, however, differs from that of Harris's in the following respects: 1) anisophylly of a whorl is more pronounced, 2) leaf is shorter and broader (70 mm. long by 5 mm. broad in the former, while 90 mm. by 3 mm. in the latter), 3) leaf is linear-lanceolate and not petiolate, 4) leaf-whorl consists of about 10 leaves instead of 14–18 in the latter, 5) terminal whorl is large and fan-shaped. Thus the present type-specimens are distinct enough from *N. carcinoides* to be worthy of specific rank. Besides the types, all the other specimens of both Major and the Minor types resemble also closely the type-specimen of Harris's, especially in feature of the basal region of the leaf-whorl. Thus it is sure that the present Miné species resembles very closely the leafy lateral stem of Type B of Harris's species. However, with the Yenchang specimens appears the matter quite different. To judge from six figures of the leafy lateral shoot given by Sze (1956), in the Yenchang specimens a leaf-whorl is generally divided into two lanceolate or linear-lanceolate lobes, leaving between them wide gaps in both basal and the apical sides of the whorl; leaves in each lobe run nearly parallel with each other for the most part of their length and then often slightly converge together in their apical region. In the present Miné species, on the contrary, each lobe of a whorl is cuneate or obovate in form with its leaves not convergent but divergent throughout their whole length. Thus so far as concerning with the form of the sheath-lobe only, the Yenchang specimens, as previously suggested by P'an (1936, pp. 13–14) with his material, resemble *Schizoneura* more closely than any other known species of *Neocalamites*. Moreover in *Neocalamites* the midrib of the leaf is thick, persistent and single or double in composition, often terminating in a stiff mucro at apex of the leaf, while in *Schizoneura*, as cleared up by Wills (1910a, 1910b), the midrib is multiple being composed

of several fine nerves. In the Yenchang examples, according to SZE (1956, p. 120), "the midrib of leaf is generally not very conspicuous on some specimens.", and accordingly they differ in this respect also from our Miné species, but appear to resemble to some extent *Schizoneura*. They cannot, however, belong to *Schizoneura*, if the following interpretation of SZE's (1956, p. 120) is correct as: "The whorl of leaves are probably flattened into plane of axis by twisting of petiole during the life of the plant. The leaves are usually free to their bases.", because in *Schizoneura* leaf-whorl is generally divided into coherent and constantly amplexicaul lobes. But it seems often quite difficult to determine whether these leaf-whorl were originally flattened in the plane of axis during the life of the plant or they were originally amplexicaul and subsequently crushed during fossilization so as to assume also such the flattened condition. When the presence of the fan-shaped terminal whorl as well as the anisophyllous leaf-whorl is clearly ascertained, then such the leafy branch can prove to have the leaf-whorl originally flattened in the plane of axis instead of amplexicaul, but among specimens reported by SZE (1956) neither fan-shaped terminal nor markedly anisophyllous leaf-whorl can be found. From the same formation many well-preserved specimens of the main stem were reported by SZE under the name of *Neocalamites carcinoides* HARRIS, but it is not always easy to distinguish *Neocalamites* from *Schizoneura* by means of the feature of the leafless stem. ZEILLER (1902, pp. 26–27, Pl. VI, fig. 1) reported a similar specimen of the main stem of about 31 mm. width attached in organic connection by a lateral leafy branch of definitely of *Schizoneura gondwanensis* type, in which, according to ZEILLER (1902, p. 26), "les côte de la tige tantôt alternent d'une articulation à l'autre et tantôt traversent sans déviation l'articulation." Further, numerous similar examples of the main stem belonging evidently to *Schizoneura paradoxa* were reported by WILLS (1910a, 1910b) from the lower Keuper beds in England. In general feature, at least the specimens of WILLS's A type quite agree with *Neocalamites hoerensis* and others, and, according to WILLS (1910a, p. 281), "It is of interest to note that whereas in *N. hoerensis* and also *N. carrerei* these prints (leaf-scars) are separated by only one or two ridges, in our specimens there may be as many as eight between two consecutive ones." In the Yenchang stems, according to SZE (1956, p. 120), "The leaf-traces are separated, in large stems by about 5–6 ribs occasionally by 7 ribs, and in smaller ones by 4 ribs." The leaf-whorl of the leafy branch is composed in the Yenchang specimens of 10 leaves of more than 20 cm. length by 5–6 mm. width, while in species of HARRIS's and WILLS's it consists of 14–18 leaves of 9 cm. length by 3 mm. width, 7 leaves of more than 12 cm. in length by 5–6 mm. in width, respectively. Thus in various respect this Yenchang plant appears to show some intermediate feature between *Neocalamites carcinoides* HARRIS and *Schizoneura paradoxa* WILLS sp., which tells these specimens of SZE's seem to be somewhat considerably different from the species of HARRIS's. Thus we come to the conclusion that the present Miné species resembles most closely *Neocalamites carcinoides* HARRIS (non SZE), but differs even from the latter in that the leafy stem is more markedly dorsiventral with anisophyllous leaf-whorls either lateral or terminal. As above stated *N. carcinoides* was established in 1931, but thereafter in 1937 this generic name was sub-

stituted by HARRIS himself for *Lobatannularia* in acceptance of such opinion of KAWASAKI's (1934, p. 66) that "HARRIS specimen shown in text-fig. 5A under *Neocalamites carcinoides* sp. nov. closely resembles *Lobatannularia* in the characteristic arrangement of leaves of whorls." This substitution, however, was not accepted by the present senior author, ASAMA and SZE, who insisted to call it by HARRIS's original generic name. But it is evident that the leaf-whorls of *N. carcinoides* show some slight resemblance to those of *Lobatannularia*, and further that those of the present species bear more resemblance to *Lobatannularia* than the species of HARRIS's in having the more markedly dorsiventral lateral shoot with large fan-shaped terminal whorls and clearly anisophyllous leaf-whorls. The reason why we would prefer to place the present species too in *Neocalamites* instead of *Lobatannularia* can be found in the reason why this substitution of HARRIS's was not accepted by us as will be discussed in details in the next chapter.

Notes on *Neocalamites* and *Lobatannularia* and conclusion

There is no doubt that the present Miné species is referable to either *Lobatannularia* or *Neocalamites* and not to any other genera hitherto known. *Lobatannularia* is the Permian plant known only in the Cathaysian Flora and its single survivor, *L. nampoensis*, in Rhaeto-Liassic flora in Southern Korea. On the other hand *Neocalamites* is a wide-spread plant in the older Mesozoic, occurring most abundantly in Keuper and Rhaeto-Liassic formations in the world. Thus the respective age of zenith of their luxuriance is somewhat remotely separated, and consequently the typical species of each genus are easily distinguishable from one another. However, there are many forms intermediate in feature between them, e. g. *Annulariopsis inopinata* ZEILLER, *Lobatannularia ensifolia* var. *nariwaensis* KOBATAKE, etc., and the present species is also the same case.

Genus *Lobatannularia* (s. l.) is characterized by such features as: 1) leaf-segment is uninerved, either spatulate, oblanceolate or linear in form; 2) leaf-whorl markedly anisophyllous, flattened in one plane nearly parallel to axis; 3) ultimate leafy branch generally has a circular fan-shaped terminal whorl and lateral leaf-whorl divided into two coherent lobes leaving a wide gap in the basal side of a whorl; 4) main stem at least twice branched, with penultimate lateral stem showing very characteristic ramification. Although as to the feature of the main stem nothing has been known, various opinion were expressed on the ramification of the penultimate lateral stem by HALLE (1927, 1928), KAWASAKI (1934), KON'NO (1933), KON'NO and ASAMA (1950), etc. KON'NO and ASAMA (1950, p. 23) gave a brief summary on the ramification in describing two types of it: the one shown by *L. sinensis* (HALLE), *L. lingulata* (HALLE), and *L. heianensis* (KODAIRA), and the other represented by *L. ensifolia* (HALLE). The first type shall be called pseudosympodial distichous and the second was called pseudodichotomous by HALLE (1927, p. 21). In the first type, as pointed out by HALLE (1928, pp. 244–245), each pair of ultimate branches are arranged in two rows on the flanks of the penultimate axis, and the branches of each side are quite unequally developed—long branches with numerous whorls alternate with short ones carrying only a few or a single whorl; on

the upper part of the same mother-axis the shorter branches become undeveloped by abortion and at the same time the longer ones are also shortened and remain in solitude at each node; at last even the solitary branches entirely disappear in the apical part of the same axis. It is quite noteworthy that this particular plan of branching remained unchanged from the beginning of the age of *L. sinensis* (of Taiyuan, the early Permian), through *L. lingulata* to the end of that of *L. heianensis* (of Upper Shihhotze Series, lower of the later Permian). Other characters, e. g. cohesion of leaves of a whorl changed progressively along the trend from non-cohesion to complete cohesion. To say in other words, these three species, i. e. *L. sinensis*, *L. lingulata* and *L. heianensis* represent one distinctive group to be called *Sinensis-lingulata-heianensis* Series, and this Series can be regarded as a direct descendant of genus *Annularia*. On the contrary other type of ramification shown by *L. ensifolia* is characterized by four branches at a node, and accordingly it appears essentially different from the first type as well as *Annularia*. For this reason *L. ensifolia* should be excluded from the typical *Lobatannularia* (s. s.) characterized by Pseudosympodial distichous ramification, and be placed in *Annularites* HALLE 1927, as previously suggested by KAWASAKI (1934, p. 68).

Neocalamites was first proposed by HALLE for such three species as: *Schizoneura hoerensis* SCHIMPER (type-species), *Sch. Meriani* (BRONGN.) and *Sch. Carrerei* ZEILLER in 1908, when he said as follows: "Ich habe es für zweckmässig gehalten aus die Gattung *Schizoneura* die *Sch. hoerensis* SCHIM. und andere Arten mit konstant freien Blätter auszumerzen." (HALLE, 1908, p. 6). In *N. Carrerei* and *N. hoerensis* the main stem is once branched with a single or a few branches in a whorl respectively on certain of the nodes (ZEILLER 1903, p. 137; HALLE, 1908, pp. 10–11). After studying various Equisetacean plants from Keuper beds in Germany, FRENTZEN (1933) gave a splendid restoration of *N. Meriani* (BRONGN.), in which the main stem is drawn to be twice branched and the penultimate lateral stem to bear a single

Explanation of Plate 40

(All figures are of natural size)

Neocalamites minensis KON'NO et NAITO, n. sp.

(Figs. 1a, 1b, 1c, 2: Major type; Figs. 1d, 1e: Minor type)

Fig. 1a. Counterpart of type-specimen shown in Pl. 41, fig. 4; lower leaf-whorl shows the original feature of very wide basal gap of a whorl with linear-lanceolate basal leaves. (IGPS coll. cat. no. 76236)

Fig. 1b. Other specimen with 4 internodes and 4 leaf-whorls, similar to those shown in fig. 1a.

Fig. 1c. Terminal leaf-whorl with apical leaves pointing straightly forwards.

Fig. 2. Distal part of a branch with a terminal leaf-whorl, in which a right-hand basal leaf shows its original linear-lanceolate outline. (IGPS coll. cat. no. 76236)

Fig. 1d. 4 minor branches are preserved having their axes nearly parallel with one another; each with a characteristic terminal leaf-whorl.

Fig. 1e. Distal part of a small stem with small branch-like shoot one on each side of the lowest node.

KUMAGAI photo.

branch at a node. We are not certain by what fossil evidences his restoration of the penultimate stem was drawn, but such the ramification of the lateral stem seems for us to be highly possible to occur in *Neocalamites*. However, with the ramification characterized by distichous arrangement of branches on the lateral stem, seems the matter quite different. Berry (1912, pp. 174–180, fig. 17) reported a very peculiar Rhaetic plant from Virginia in U. S. A. under the name of *Neocalamites Knowltoni* n. sp. Only a single specimen was figured in his paper, in which the axis is 8 mm. across with six pairs of opposite dorsiventral leaf-bearing branches preserved in organic connection to the axis; leaf-whorls of the lateral stem are flattened in the plane nearly parallel to the axis; leaves in a whorl are free to the base, of approximately the same size, linear-lanceolate and about 15 mm. long. Besides a pair of opposite leaf-bearing branches, one or two branch-scars are also seen on some of the nodes, and these scars, according to Berry, may be interpreted as the scar of such aborted or non-persistent branches. Berry (1912, pp. 178–179) said as follows: the 8 mm. wide axis of the figured specimen, "with its leaf-bearing subordinate branches, is interpreted as a lateral branch which was distinctly bifacial in habit.—It is more like *Calamites*, however, than the species which Halle has referred to the genus, and suggests most strongly the *Annularia* type of Paleozoic *Calamites* foliage, for example, the widespread type known as *Annularia sphenophylloides*,—." If this interpretation of Berry's is correct, then in this American plant the main stem must be twice branched; the penultimate lateral branch bears distichous ultimate leafy branches of distinctly bifacial habit; if so, then this scheme of branching cannot be of the *Neocalamites* type, but evidently of *Annularia* type, as suggested by Berry himself. Nevertheless, longitudinal furrows on the surface of the stem are not alternate at the node, and in this respect it is more like *Neocalamites* stem than *Calamites*. Despite of such remarkable departure from the typical *Neocalamites*, Hirmer (1927, p. 463) and Harris (1931, p. 22) placed this American species in *Neocalamites* without giving any important comments, but such references seem to be quite doubtful for us. We would rather prefer to exclude this American species from the typical *Neocalamites*, which is characterized by free leaves of a leaf-whorl and a single or many branches arranged in radial symmetry at a node. This American species, is, however, quite important in proving the fact that such the *Annularia*-like plant retaining the definitely Palaeozoic aspect was still existing in the Rhaetic age in North America.

Neocalamites carcinoides Harris, on the contrary, is evidently typical and well established, adding several important contributions to our knowledge of *Neocalamites*. The main axis in this species is once branched, with numerous lateral branches arranged in radial symmetry at a node; lateral foliage-stem is dorsiventral with leaf-whorls divided into two lateral groups, flattened in the plane of axis. Terminal leaf-whorl has not been found as yet, but its presence would be highly possible, judging from the specimen of Harris's given in his Pl. V, fig. 3. This well-founded species was, unfortunately transfered to *Lobatannularia* in 1937 only because of its leaf-whorl being divided into two lateral groups and flattened in the plane of axis. The present senior author and Asama (1950, p. 20) expressed a view against this substitution of Harris's saying "It has neither

fan-shaped terminal whorl nor characteristic branching habit of *Lobatannularia*. Accordingly it seems more preferable to separate this species from the typical *Lobatannularia*." On the same problem SZE (1956, p. 121) expressed a more decisive opinion, saying as follows: "All the characteristic forms of leafy shoots of the Palaezoic e. g. *Annularia*, *Asterophyllites*, *Lobatannularia* etc. are attached to the stems of definitely *Calamites*-type. For this reason, the writer would prefer to name the Greenland species as *Neocalamites carcinoides* HARRIS." Though about the main stem nothing has been known, *Lobatannularia* is sure to be essentially different in ramification from *Neocalamites*, and in this meaning the present authors agree with SZE in his view. Thus *N. carcinoides* is evidently one of the typical species among *Neocalmites* and also characterized by its dorsiventral (probably plagiotropical) branches arranged in radial symmetry at the node. The present Miné species coincides with this species of HARRIS's in various characters as: the leaves in a whorl are entirely free even in its distal part of the ultimate stem; leaf is not oblanceolate but long linear-lanceolate in form; lower leaves nearest to the basal gap of the whorl are also linear-lanceolate instead of spatulate as in *Lobatannularia*. For this reason we would prefer to place this Miné species too in genus *Neocalamites*. Unfortunately, however, we have no reliable evidences at present to prove its ramification, and so far as its ramification is left uncertain, the reference of the present species to *Neocalamites* would also be not decisive but only provisional.

Before leaving the subject of the taxonomy of the present species, attention may be called once more to the following remarks of SZE's (1956, p. 121): "For this reason, the writer would prefer to name the Greenland species as *Neocalamites carcinoides* HARRIS, and the same can be said for the Liassic species of Korea which was first determined by KAWASAKI as *Schizoneura nampoensis* (KAWASAKI 1927, Pl. VII, fig. 29; see also OISHI 1940, p. 186). This single specimen found from Korea is certainly also attached to the stem of definitely *Neocalamites* type." We have, however, not been acquainted with the specimen of *Lobatannularia nampoensis* having the stem good in preservation enough to prove the feature of the nodal region of definitely *Neocalamites* type. Of three specimens figured by KAWASAKI from one and the same locality, the one (KAWASAKI, 1927, Pl. VII, fig. 29) represents a typical form

Explanation of Plate 41

(All figures are of natural size)

Neocalamites minensis KON'NO et NAITO, n. sp.

(All specimens; Major type)

Fig. 1. Largest specimen with internode of 5 mm. in width. (IGPS coll. cat. no. 76237)

Fig. 2. Portion of a leaf-whorl with 2 leaves showing nearly complete outline. (IGPS coll. cat. no. 76237)

Fig. 3. Stem with 2 lateral leaf-whorls, each of which divided into 2 outward pointing lobes consisting of rather narrow leaves. (IGPS coll. cat. no. 76235)

Fig. 4. Type-specimen (see also Text-fig. 2B). (IGPS coll. cat. no. 76237)

Fig. 5. Type-specimen (see also Text-fig. 1B). (IGPS coll. cat. no. 76234)

KUMAGAI photo.

of the fan-shaped terminal leaf-whorl of *Lobatannularia*-type, characterized by leaves of considerably dissimilar length, and the other (Kawasaki, 1931, Pl. XVIII, fig. 11, 11a) shows the stem with lateral leaf-whorls divided into two coherent lobes, in which the ratio of length of the longest leaf to that of the shortest is about 3. For this reason, though about its ramification nothing has been known, this Korean Liassic species would be more preferable to place in *Lobatannularia* instead of *Neocalamites*.

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PROCEEDINGS OF THE PALAEONTOLOGICAL SOCIETY OF JAPAN

日本古生物学会第 76 回例会は，1960 年 9 月 24 日，島根大学文理学部地学教室において開催された。(参会者 22 名)

特　別　講　演

The Echinoid Fauna of Japan and adjacent regions, Its composition and Its origin ..... Syozo NISIYAMA

例　会　講　演

広島県神不郡三和町城江石灰岩産上部二畳系紡錘虫化石動物群について .....佐田公好

On some representative species of *Parafusulina* zone in the Atetsu Limestone plateau, Okayama Prefecture..... ..... Kimiyoshi SADA

Sinopora dendroidea (YOH), a Late Permian auloporid coal from the Taishaku limestone, Japan (代読).....Kenji KONISHI

Some Lower Carboniferous Brachiopods from the Akiyoshi Limestone Group.. .....Juichi YANAGIDA

On the Tertiary Marine Mollusca from the Joban Coal field, Japan..... .....Yasuhiko KAMADA

A new species of Miocene Gastropoda (Mollusca) from the Ginzan Hot-Spring, Yamagata Prefecture, Northeast Honshu, Japan (代読) ....Kotora HATAI and Tamio KOTAKA

Conacean Gastropods from the Miyazaki Group .....Tsugio SHUTO

Some Voltacean Gastropods from the Miyazaki Group ....Tsugio SHUTO

Graysonites from Kyushu..... ..... Tatsuro MATSUMOTO

Problematical Markings on the under-surface of a Miocene Tuffaceous siltstone, Yamagata Prefecture, Japan (代読).... .....Kotora HATAI and Tamio KOTAKA

岩手県花泉に於ける哺乳類化石の産出状態について（標本並びにスライド使用）花泉研究団体報告 .....早坂一郎・尾崎博 他

SYSTEMATIC INDEX

(Note: Every reference is to the number of article and of short note)

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INDEX OF FOSSILS

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41(Mar.-May)/1940

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10(1-47)/1934, 11(1-39)/1935, 12(1-45)/1936, 13(1-46)/1937, 14(1-60)/1938

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5(4, 6, 9, 12, 16, 17, 20)/1927-1929, 6(2, 4, 25)/1930, 1931, 7(4, 8, 10, 19, 20, 22)/1931-1933, 8(8, 9,

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14(4-9)/1958, 15(1-6)/1959

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Kazakhskaya

News, Academy of Science, Kazakhskaya, SSR.
2(14)/1957

日本古生物学會
報告・紀事

Transactions and Proceedings
of the
Palaeontological Society of Japan

New Series
No. 33～No. 40
1959～1960

日本古生物学会

Palaeontological Society of Japan
November 30, 1960

The heading in Japanese commemorates the handwriting of Prof. M. YOKOYAMA, father of Japanese Palaeontology, who was Professor of Stratigraphy and Palaeontology at the Geological Institute, Imperial University of Tokyo.

The fossil on the front page is *Didymoceras awajiense* (YABE), 1901.

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例　会　通　知

	開催地	開催日	講演申込締切日
創立25周年記念講演会	神田学士会館	1961年1月14日	
1960年総会，年会	東京大学	1961年1月15日	1960年11月30日
第78回例会	秋田大学	1961年5月中旬	1961年4月30日

学　会　紀　事

常務委員会は評議員会にはかり，次の事を決定した。
朝日賞に会員松本達郎君の研究“日本及び北アメリカ白堊紀菊石の研究”を推薦することとした。
本会誌の出版は一部文部省研究成果刊行費補助金による。

会　員　消　息

会員 M. L. Thompson 君は本年7月フルブライト交換教授として来日し，九州大学その他で，講義を行った。なお本会は地学協会と共催で“フズリナの進化について”の同君の講演会を東京大学で開催した。

News

◎ International Palaeontological Union の第5回総会は Copenhagen で8月 22～24 日開かれ会長小林貞一君が出席した。役員選挙では Chr. Poulsen が次の President に選ばれた。Secretary, Treasurer は留任，Executive Committee 5名中3名が改選され，小林が参加する事になった。

Liste des Paléontogistes du Monde が出来た。

Committee on Palaeoecology が設置され，N. D. Newell が委員長に指名された。

第6回総会は 1964 年インドで，その他スペイン (1961)，ドイツ (1962)，フランス，モロッコなどで部会を開く予定である。

(1) Palaeoecology, (2) Calcareous Algae, (3) Primitive Invertebrates, (4) Primitive Tetrapods 等に関する諸 Symposia があり，(2)に会員小西健二君が2論文を寄稿していた。Glaessner の発表した南濠洲に於ける保存良好な先寒武紀化石の発見は特に注目を惹いた。

◎ 本会邦文特別出版物「化石」No. 1 がこの程出版された，これには本年1月仙台で開催されたフズリナに関する討論会の記事がおさめられている。　配布価格一部 300 円。

購読御希望の方は本会宛御申込下さい

1960年11月25日　印　刷
1960年11月30日　発　行

日本古生物学会報告・紀事
新　篇　第40号
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Regulations for Publication in Transactions and Proceedings of the Palaeontological Society of Japan

(1958, 12, 6)

1. Manuscripts considered for publication should have been read at the General Meeting or the Ordinary meeting of the Palaeontological Society of Japan.
2. Manuscripts shall be written in European language, they should be typed on one side of standard-size (22.5×27.5 cm) paper and double-spaced throughout. Biological names should be in italics and be underlined by the author.
3. Manuscripts (including of text-figures, maps and tables) will be limited to 8 printed pages (less than 18 type-written pages).
4. Illustrations will be limited to one plate (14.2×20.0 cm).
5. Text-figures (2 if less than 6 tsubo, 1 tsubo is 1 square sun) should be drawn carefully on white paper with drawing or Indian ink, letters used in the figures should be either printed or typed letters pasted-in. Figures may be reduced, so authors are requested to carefully select the size and thickness of the lines or letter used.
6. Maps should be accompanied with scale, fractions should not be used.
7. The author is requested to pay for any cost extending beyond the above stated regulations.
8. Manuscripts should have the title and a brief abstract in Japanese, (such will be added for persons not familiar with Japanese language).
9. Literature cited or referred to should be listed at the end of the manuscript in the form of bibliography. Bibliography should be arranged in alphabetic order of author and by year. The order will be, Author, Year, Title of Paper, Name of Journal, Volume, Page, Plate, Figure, Map, Table.
10. The author's official address should be given below his name, under the title.
11. Palaeontological notes which can be fitted into less than one printed page (including figures, maps, tables) will be published in the order received as space becomes available.
12. The desired number of reprints should be indicated on the right corner of the front page of the manuscript. 100 reprints without cover, but with reference to volume, number and year will be furnished free of charge to the author (if more than one author is involved they shall be divided). Additional reprints will be furnished at the printers rate.

Editorial Regulations

1. The Editorial Staff will transact, preserve and edit the manuscripts.
2. When the Editorial Staff transacts a manuscript, a notification with date of acceptance will be sent to the author, if the manuscript is clear, and abides with the regulations.
3. Acceptance or non-acceptance of manuscripts will be decided by the Editorial Council.
4. Manuscripts not accepted for publication will be returned to the author with notification from the Editor of the reason(s) for its rejection.
5. Manuscripts accepted will be published in the order received with the date of acceptance indicated thereon.
6. Manuscripts whose contents are altered by the author after being accepted for publication, will have their date of acceptance changed.
7. The printing style will be as Journal of Paleontology.
8. Proof reading will be done under the responsibility of the Publication Committee.